DDV

Data Deja View's
Guide to

Understanding and Using Application Coyote

Coyote-Produced Symbols:

Application Coyote symbol generation packages may be individually downloaded from ESRI's ArcScripts.

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Introduction

To DDV this was an interesting project; the search for a problem solution, the font and system design innovations, and the new user features – this is what made this project fun and, in the author's opinion, successful. It is to be hoped that the users will concur.

Suggested Use – The Guide is meant as an adjunct learning tool. The Introduction and Wizard user interface remain as the primary tools for first-level learning about and using Coyote.

The Guide is meant to serve two audiences. First, for prospective application users, it gives an overview of what Coyote is all about and as much detail about its design and any features of interest as they are likely to need to decide if it will be beneficial for them to download and install one or more Coyotes. The prospective user may want to read Sections 1 and 2, and then browse Sections 4 and 5.

A second purpose is to give current Coyote users more background as to the design, implementation tradeoffs and features inherent in Coyote. Understanding these areas will enable users to make better use of the more advanced Coyote capabilities. For these users, reading of Sections 3 and 4 is recommended.

Designing and implementing this application presented some interesting challenges. There were several areas where tradeoffs between application response time, user functionality and implementation effort offered difficult choices. The tradeoffs have been discussed in this Guide to give Coyote users an understanding of why Coyote operates as it does when in some cases, from the user perspective alone, another choice might have been preferable.

Distribution and Updates - Distribution of the Guide is made through ESRI's ArcScripts. It will be updated only if significant new features are implemented in new Coyote versions. It is intended to convey understanding of the overall application concept and its major feature capabilities, rather than as documentation for each individual Coyote implementation. This approach was necessitated by DDV workload concerns.

SECTION 1. - APPLICATION OVERVIEW

Project Definition – Application Coyote is a family of symbol generation packages for pre-numbered highway symbols. Coyote was designed to address three problems Data Deja View (DDV) has encountered while making these and other pre-numbered symbols for the ESRI user community:

1. The large update workload due to route number addition and change requests,
2. The impracticality of using very large symbol sets in ArcMap, and
3. The impracticality of meeting all jurisdictions' needs.

The chosen solution provides fonts and an executable capable of producing symbols for a very wide range of route numbers for one type of highway shield; e.g. county routes. A Master table of routes and a user interface are provided to allow the user to mark the routes for which symbols are to be generated. The executable checks the Master Table to see if a symbol is to be created. Different packages of executables, fonts, etc. are provided for each different shield type.

A font creation workload problem was overcome by changing the traditional symbol layer design methodology. Some of the gains from this were negated by the need to implement artificial kerning in order to retain high quality symbols. The normal DDV symbol creation process was modified to use a Master Table of route identifiers and to accept user-provided run parameters. Forms-based user interfaces were also included.

The potential user base for Application Coyote is very large, encompassing all Wintel-based ArcGIS 9 Desktop users with mapping needs within the United States that include highway features. Coyote Stylesets, once created, can also be used with ArcGIS 8.

Coyote currently exists in Interstate, US-Route and county-road versions. A generic state route version is under development. Application Coyote is distributed free of charge from ESRI's ArcScripts.

Application Features – Coyote lives up to its namesake's reputation as a "trickster", employing a number of design and programming tricks to: save implementation effort, improve application response times and provide new user-capabilities. Coyote features include:

1. An easy-to-use Master Table Interface;
2. The ability to create an alternate symbol layer color scheme for user-selected symbols;
3. For some symbols, the capability to create different designs using the same set of symbol layers;
4. The ability to use either complete Master Tables or, where alpha route numbers are not needed, smaller versions of the Master;
5. Availability of new "headed" routes (Scenic, Toll, Detour, etc.);
6. Symbol naming capabilities that make it much easier to use ArcMap's Match Symbols to a Style;
7. For Interstate symbols, the addition of shields with north, south, east or west designations; and
8. Automatic programmed layer color control for some "headed" routes.

Learning and Using the Application – Introductory forms and a wizard-based user interface are the primary tools for learning and first using this application. Wizards provide step-by-step guidance through the symbol creation process. Their forms are usually limited to one or two closely related tasks. They may include information about the task, tips for carrying it out and/or recommendations relative to it.

There is also a much more compact user interface for experienced users. Message box error and warnings messages are used extensively in both user interfaces.

The application's Help file covers problem areas, troubleshooting and common application information in detail. With the exception of version and required files information, Help is generic. It is left to the introductory forms and the wizards to provide information on application features, which vary from one Coyote version to another.

SECTION 2 - HARDWARE AND SOFTWARE REQUIREMENTS

2.1 Development Environment

The application was developed using Microsoft Visual Basic 6.0 (SP-3) with standard components. Symbol generation coding uses as references the ESRI Framework Object Library and the ESRI Display Object Library (both from ArcGIS 9 SP-3). The database is Microsoft Access 2000.

Note: Neither of the above components needs to be installed on user computers to run the application.

2.2 User Environment

DDV is limited as to test facilities, and has only one floating ArcGIS license. Testing was carried out on two platforms.

Test Platform One:
- Dell Workstation with one 1.5 GHz processor and 256 MB of RAM. Nvidia GeForce2 GTS video card (32 MB).
- OS: Microsoft Windows XP Professional Version 2002 (SP-1).
- ESRI ArcGIS 9.1

Test Platform Two:
- Dell Notebook with 1.6 GHz processor and 256 MB of RAM. Nvidia GeForce4 440 Go video card.
- OS: Microsoft Windows 2000 Version 5.00.2195 (SP-4).
- ESRI ArcGIS 9.0 SP-3

Hardware Requirements – Any Wintel-based computer capable of running ArcGIS Desktop should suffice for running this application. Coyote forms are intended for use with monitors having a display resolution of between 1024 by 768 pixels and 1600 by 1200 pixels. Resolutions less than this may not be able to display some forms in their entirety. Resolutions at or above the intended maximum may not be readable with smaller size monitors.

Disk Space: Small Coyote versions (e.g., County) require 50 MB for initial installation and 30 MB for each new Master copy created.

Large Coyote versions (e.g. Interstate, US) require 320 MB for initial installation and up to 120 MB for each new Master copy created.

Software Requirements – Application Coyote is intended only for use with Microsoft Windows 2000 or Microsoft Windows XP Professional operating systems (OS). It has not been tested with any server OS version.

ArcGIS 9.0 or above must be installed on any computer that is to run Application Coyote. While some portions of the application may appear to run successfully on computers without it or with earlier versions of ArcGIS, it will not be possible to generate Styles. The Sentinel hardware key does not have to be in place for the application to run. **Important Note:** Styles created by this application can be used with ArcGIS 8.

2.3 Installation Instructions

Each Application Coyote package is distributed as a WinZIP file. When extracted there will be a setup executable (setup.exe) which, when run, notifies the user of installation requirements (required software and user permissions) and prompts the user for necessary responses (licensing agreement, install location, etc.). It then installs all portions of the package: fonts, executable, database(s), etc.

Each Coyote includes a number of True Type Fonts. DDV has noted the relatively high number of problems that the ESRI user community has encountered in the past related to font installation (and later "loss" of fonts). Included in the application Help file is a section called Troubleshooting Fonts. This information has significantly reduced trouble calls since DDV started including it in all marker set distributions.

2.4 Licensing and Rights

The full licensing agreement is contained in the install package and must be accepted for installation to proceed. The application is being made available to the ESRI user community for use without charge and without warranty. The author has retained copyright ownership of the application. Source code is not being made available. Users of the application may distribute the symbols created with the application and their font files, provided there is no charge or fee associated with such distribution. Note: as with all marker symbols, Coyote symbols cannot be used on a computer without the necessary fonts also being installed on that computer. Please read the entire install license agreement for full licensing and warranty disclaimer information.

SECTION 3 - PROJECT DEFINITION

3.1 Problem Overview

Why Coyote? There are three main problems that Data Deja View (DDV) has encountered while addressing pre-numbered/pre-lettered (PN/PL) marker symbol needs for the ESRI user community. These problems are the driving forces behind the creation of Application Coyote.

Overwhelming Maintenance Workload - DDV is not able to keep up with the workload to maintain existing PN/PL sets and still properly address other facets of the DDV mission. Some state DOTs are fairly active in new highway creation and/or re-numbering of existing routes. For several DOTs, getting information about this has been very difficult or impossible. Unofficial highway route-related Internet sites, where existing, are not always current. Non-DOT user update requests, while very much appreciated, often call attention to only a portion of the changes in a particular states' route numbering. The workload associated with this has now become untenable. To DDV, not maintaining these sets (and letting their usefulness diminish to the point where people no longer want to use them) is also untenable.

Times Updated:	1-Time	2-Times	3-Times	4-Times	5-Times	6-Times	7-Times
Number of State Sets:	27	8	4	2	3	1	2

Impracticality of Very Large Symbol Sets – In ArcMap each time a user manually assigns or changes a symbol, the Symbol Selector must be opened and all symbols in the included marker sets loaded. Then the user must scroll down through the window to select the desired marker. With large symbol sets this can involve a significant amount of time.

> Example One: The Milemarker Set with 999 symbols – averages 3.5 seconds to fully open (and load) the Symbol Selector plus 4.5 seconds to scroll and locate the marker. For only 25 such symbols almost 3½ minutes could be used up for opening and scrolling; all unproductive time.
>
> Example Two: All possible US Routes (1, 1A, 1B, ….. 999Z) with 26,973 symbols – approximately 6 minutes to fully open (and load) the Symbol Selector and 20 seconds to scroll and locate the marker. For only 25 such symbols more than 2½ hours could be used for opening and scrolling; all unproductive time.

Impracticality of Meeting All Jurisdictions' Needs – Given the number of U.S. counties, towns and other existing jurisdictions, it would not be feasible to produce individual marker sets containing only those symbols needed by jurisdiction, even without considering the maintenance issue.

Resulting Unmet Needs - DDV knows of six state highway sets that are currently incomplete/out-of-date. It is assumed there are a number of others in the same condition and that more will become so as time passes. In addition, DDV has long wanted to address such PN/PL symbol needs as: Indian routes, county roads, National Forest Service roads, tenth-of-a-mile markers, hundredth-of-a-mile-markers, residence/facility numbers, etc. At a minimum these sets would have a possibility of 9,999 symbols and one the possibility of more than 450,000 symbols**.** Clearly, symbol sets of that size are not practical.

Application Coyote has been designed to address, at least in part, all of these problems.

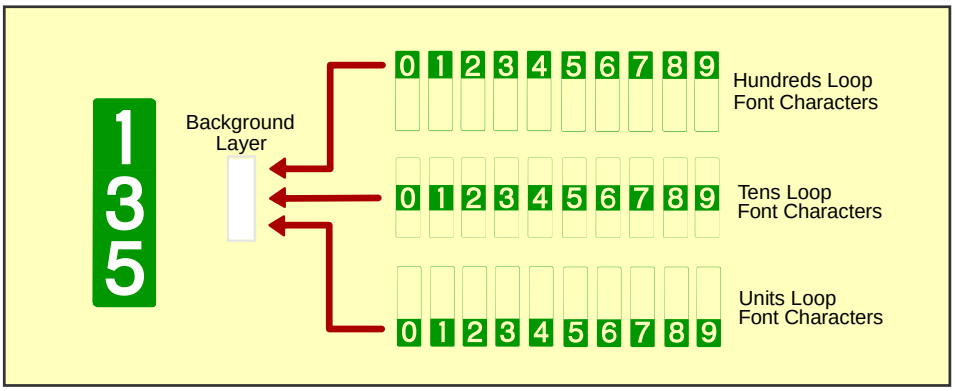
3.2 Solution Overview

The chosen solution provides an executable that is capable of producing a very wide range of route numbers for one type of highway shield; e.g. county routes from 1 to 9,999. It allows the user to select those routes for which symbols are actually to be generated. Different executables are provided for different shield types (Interstate, US Routes, etc.) To implement this solution a major problem had to be overcome.

Potential Font Creation Workload - DDV uses True Type Fonts (TTFs) to create marker symbols because of the high quality results that can be obtained with them. Creating the font characters is the most time-consuming task in the marker creation process. With the standard approach to creating highway shields, at least one font character is used for each route symbol to be included in a set. If the number of potential symbols is significantly increased, there will be a corresponding increase in the workload. Absent a means of drastically reducing the font creation workload, this solution would not be feasible.

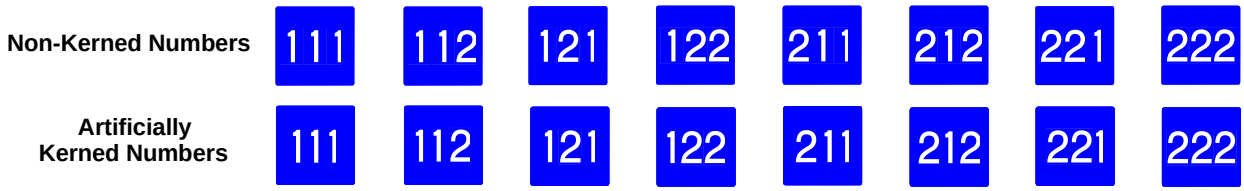
First Symbol Design Breakthrough - Several years ago DDV began designing fonts for some sequentially numbered sets that can "reuse" the font characters. For example, a milemarker symbol set was created for mile 0 to mile 999 (1,000 symbols). Ten font characters were created for the units position (0 through 9), all of them being aligned to the same position. Similarly ten were created for the tens position, and ten for the hundreds position. Four font characters were used for outlines, masks, etc. Thus only 30-odd font characters were needed to produce 1,000 marker symbols. By incorporating three-deep nested loops in the symbol create program, a relatively few instructions could generate all 1,000 symbols.

Mile Marker Symbol Constructs

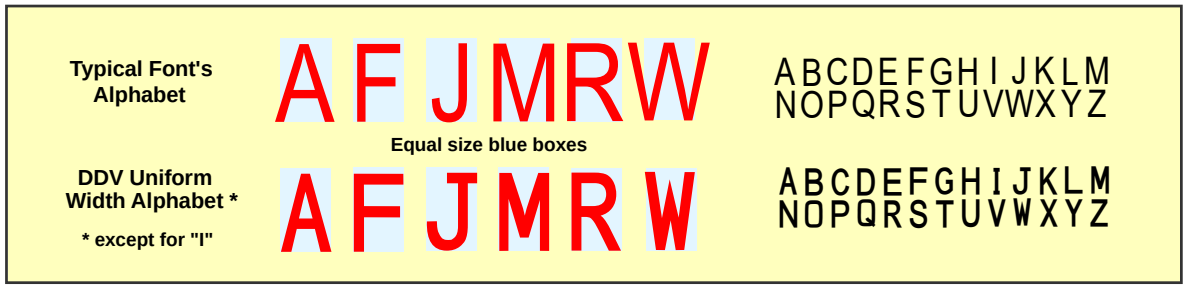

1
3
5
Background Layer
0 1 2 3 4 5 6 7 8 9
Hundreds Loop Font Characters
0 1 2 3 4 5 6 7 8 9
Tens Loop Font Characters
0 1 2 3 4 5 6 7 8 9
Units Loop Font Characters

This was a great breakthrough, but had severe practical limitations. The above worked very well for vertically aligned designs, such as mileposts. However, for horizontally aligned symbol designs, the resulting quality was not up to DDV standards. This is because the automatic kerning capabilities built into fonts cannot be utilized in marker symbols.

Second Symbol Design Breakthrough – The number "1" was the major kerning culprit in the above example. Some experimentation showed that acceptable results could be obtained by making separately aligned font sets for each combination of positions where a "1" would occur. For example in a number set from 1 to 999 where there are no lead zeroes and 2 equals any number *except* 1, the realignment possibilities that could need their own font sets are: 2, 11, 12, 21, 22, 111, 112, 121, 122, 211, 212, 221 and 222. While this significantly increases the number of font characters that have to be created, the results are of much better quality, as shown in the samples below.

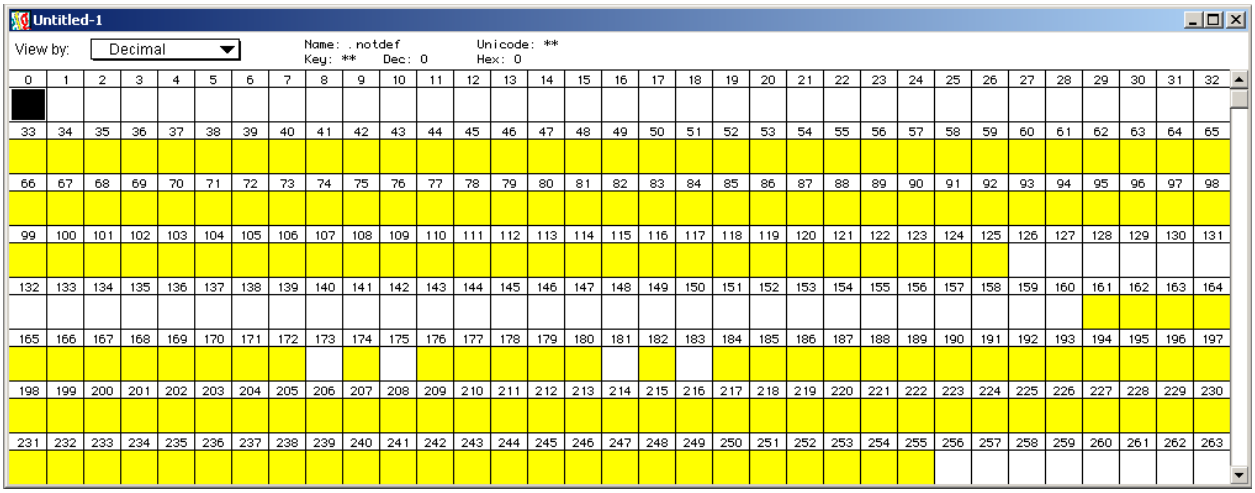


Letters present a much more difficult kerning challenge. In standard alphabetic fonts there are great variations in the width of the different characters. In order to use the same artificial kerning approach for both letters and numbers, a new font was created where all letters except “I” have the same width. While this would not give a pleasing look in word processing use, DDV believes it offers an acceptable kerning solution tradeoff for symbols.



Font Constraints – While there are hundreds of possible character positions in each font, the positions that can be used for making symbols are limited and they are not arranged consecutively. Since, to accommodate program looping, many of the font characters should be placed consecutively in groups of ten and thirty-six (0-9 and 0-9 plus A-Z), and since it is preferable not to use more than one font for the layers in the same symbol, both the font design and programming tasks were further complicated.

Valid Font Characters for Symbols Shown in Yellow



Breakthrough Impact – While at first glance it appears that artificial kerning requires more fonts than would be necessary to provide for every possible route in the traditional manner, in reality this is not true. A few examples:

To produce the 999 possible plain, numeric-only Interstate route shields (with the kerning), Coyote utilizes 231 font characters. For the alpha versions (used in a very few states), to produce 3,572 possible routes, Coyote utilizes 413 font characters.

To produce the 10,989 possible headed numeric only Interstate route shields, Coyote utilizes 322 font characters (BUS, LOOP, etc. – there are eleven possible headings).

The US-Route Coyote utilizes 92 font sets of from 71 to 100 font characters each. The possible application route numbers include: US-1, US-1A, US-1B, ... US-999Z. There are plain shields plus

eleven possible shield headings and four different design styles. This makes for over one million possible symbols that the set could generate.

While the font creation task is still very significant, for the number of possible symbols that can be generated, it is acceptable. This creation method retains almost as high a quality of symbol as when each route number was individually “custom crafted”.

3.3 Symbol Creation Process

The Original Process - The long-used DDV process for creating ArcGIS highway shield Stylesets is to:

(1) Create Fonts containing the graphics for each layer of each symbol in a set. At least one font character is required for each route to be included in a symbol set.
(2) Modify a simple VB6 template program to generate a Styleset from the fonts. The program uses the standard ESRI supplied VB6 Style-creation references. All parameters necessary for each layer (color, font name, font character, etc.) are hard coded in the program.
(3) Distribute the Styles, fonts and instructions via ArcScripts.

The Application Coyote Process - The initial concepts for Application Coyote were to modify the existing process as follows.

Fonts would be created utilizing the “reusable” font character approach and with multiple sets to provide for artificial kerning.

An Access table would be created that includes one record for each possible symbol. Each record is to contain an indicator as to whether or not a symbol should be generated (a Create field containing “Yes” or ”No”). Individual R, G and B value fields would be included in the table for each layer of the symbol. Each shield type (county, US-Route, Interstate, etc.) would have its own unique table with a unique identifier.

An easy-to-use form-based interface would be constructed to:

(A) Provide browse capabilities for loading a Master Table and naming/replacing Style files.
(B) Allow easy user maintenance of the create field and the layer R, G and B fields in the Master Table.
(C) Provide Master Table copying capabilities to allow creation of multiple masters (e.g., to accommodate different jurisdictions).
(D) Check that the Master Table had the proper unique identifier.
(E) Accept user run parameters as to which symbol design was to be used and whether a default color scheme or the user-defined color scheme in the Master Table was to be employed.

It would be unnecessary for the user to have Access, but would be preferable that Access not be used to update the Master, lest programmed interface controls be inadvertently subverted.

The style generation program would be modified as follows:

(A) For each possible route, read the Master Table to determine if a symbol should be generated for that route.
(B) Accept user symbol design and color source choices.
(C) Determine which artificial kerning font set was necessary for the chosen design of each route symbol to be generated.
(D) Apply the selected color source choice to each symbol layer.
(E) An executable version of the program would be created so the user did not have to have Visual Basic. This would be integrated into the forms-based interface.

Because of the significant differences between highway shield types (county, US-Route, Interstate, etc.), in addition to having a unique Master Table, each type would require a unique interface and executable.

However, subsequent Coyotes would be developed using a previous Coyote as a template, rather than being developed from scratch.

ESRI File-Based Program – ESRI had previously developed a sample Style generation program that reads program parameters from a database. Coyote was not based on that sample. The ESRI program can generate several kinds of Styles (not just marker symbols). While it also uses an Access database, for marker symbols it requires one record for each symbol layer (as opposed to DDV's approach of using one record per route). The ESRI sample does not have a user interface; the Access database has to be maintained using Access. The sample is available from ESRI's ArcObjects Online. The program code is not included with the sample and DDV did not have access to the code when developing Coyote.

3.4 The Project Plan

Goals – The main goal was to get DDV out of highway shield updating as much as possible and as quickly as possible. The second goal was to produce a user-friendly product set. Third was to retain the high quality for which DDV symbol sets have become known. The fourth goal was to provide a slight increase in symbol set functionality by including a means to globally change symbol layer colors.

Priorities - First addressed would be some simple numeric-only shield types, such as county numeric routes. Next would be all Interstate and US routes followed by generic designs for state shields. Some on-road shield designs would be "Coyoted" over time based on the number of users, historical frequency of update and/or ease of changing existing fonts to the on-road designs. However, there would be no all-out push to complete on-road design shield "Coyoting" for all states. Given the priorities DDV has for other work and the available DDV resources, some state shield designs would never be "Coyoted". Pre-Coyote highway shield sets would no longer be updated.

Development Approach – Development would be incremental, starting with numeric only shield types that did not have "headings" (such as are used with Alternate US-14, etc.). This approach was a huge benefit. Attempting to debug all the required features in one Coyote version, all at the same time, would have been a daunting and frustrating task.

User Impacts - For many of their mapping needs, current DDV highway shield users would no longer have to wait upon DDV action when route numbers changed. Coyote users would also gain the capability to globally change colors before generating the symbols.

The tradeoff for the user-community would be that they would have to occasionally run one or more user-friendly applications. The Coyote-produced shield sets would have almost the same quality as earlier DDV offerings. Not all on-road shield designs would be ported to Coyote and in some cases for those that were, fewer shield design options would be included.

As it turned out, a number of enhancements were added to one Coyote or another. These introduced very useful features to many shield sets and offer most potential users important benefits.

3.5 Application Limitations

Each Coyote version addresses the known current route number format(s) used for one symbol type (e.g. US-Routes). There are a few cases where one state or another has implemented some route numbers that do not conform to the general practice. Where known, these have been included, sometimes by introducing limited special logic, rather than attempting to handle a full range of the special cases.

Should the format(s) of a route numbering system change (or the known special cases be further extended), very significant modification would likely be required for the Coyote fonts, programs and Master Table(s). For example, if the US-Route numbering system were changed to include five-character route numbers or route numbers with an alpha character in other than the rightmost position, extensive

modification would be required before those changes could be handled. Also, if the design (the look) of a route shield changes, again extensive modification of that Coyote version would also be required in order to accommodate the change.

3.6 Potential Audience or "Market"

The current application Coyote family addresses potential needs of all ArcGIS 9 and above users that map the United States or portions thereof and who include highways on those maps. Coyote-produced Styles can also be used in ArcGIS 8. This makes for a very large potential audience. Distribution will continue to be made free of charge via ESRI's ArcScripts.

Given the restricted development plan, what portion of existing DDV shield users will Coyote be likely to reach? It is DDV's experience that *at least* 50% of mapping highway shield needs can be better met with generic state shields than with the on-road designs. However, DDV does admit that the user community may need some further education on this point. For the remaining on-road design needs, existing DDV state sets will continue to serve until too outdated for use. Generic shield designs can be substituted in a number of cases with only a limited negative impact on map quality.

SECTION 4 - APPLICATION FEATURES

4.1 Mission Creep

As ideas for new features occurred during development, each was analyzed as to the added user functionality it could offer, the effort that would be required to implement it, and the impact it might have on portability in using one application as a template for another. Most new feature ideas were eventually implemented. Some that were initially rejected later became feasible as a result of other feature implementations.

Impact - Project goals and priorities have been impacted to some extent. New feature implementation has been undertaken at the expense of a longer application development cycle. However, the enhanced user benefits that result are deemed to justify the changes. The user interfaces have become a little more complex (and there are more forms), but again, the enhanced user benefits are thought to justify this.

4.2 Features, Design Decisions and Tradeoffs

The major application features, the design decisions made in developing them and the tradeoffs attendant to their implementation are presented in the following paragraphs. Not all Coyote versions include all features (see 4.3 Coyote Feature Comparison).

4.2.1 Master Table Interface

DDV thanks youngest son Ned Mossman for his invaluable suggestions and guidance in implementing the Visual Basic DAO data access interface and the ListView Control for the Access-based Master Table as well as his assistance with several other VB questions. This saved a significant development effort.

The ListView Control was utilized because of the relative ease with which form table displays could be created and its capability to work with the records in memory as opposed to physically writing every change as it occurred. The latter capability allowed implementation of a good user workflow in the Master maintenance tasks.

With larger Masters, table load and update performance are of some concern, as is Access' performance with large tables in the Build Symbol Module. However, subsequent features mitigate this for many users.

One beta test suggestion was to eliminate the Master Table in favor of direct user input of the desired route identifiers. While this would work for users desiring only a few symbols, for those needing several hundred (as is typical with a number of states) that approach would be time consuming and tedious.

4.2.2 Global Layer Color Changes

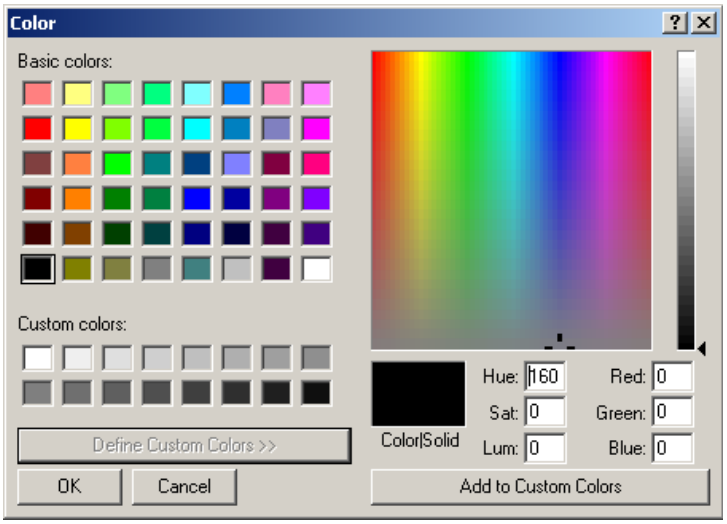
Fields were created in the Master Table to allow the storage of RGB color values for each symbol layer for each route. This means users will much less frequently have to do a symbol-by-symbol drill-down through ArcMap's menus to change symbol layer colors. Storing layer colors for each route allows different routes to be assigned different layer colors (useful, for example, to show primary and secondary highway symbols with different colors).

During initial development simple prompts were the means employed for user input of the color values. This was soon rejected in favor of the Common Dialog color picker. DDV is not satisfied with the default basic color "chips" of the picker, but has not yet researched whether or not it is possible to easily change

them. DDV believes that in most instances people will expand the picker to show the Define Custom Colors section and either use the sliders or input specific RGB or HSV values.

Initial Color Picker

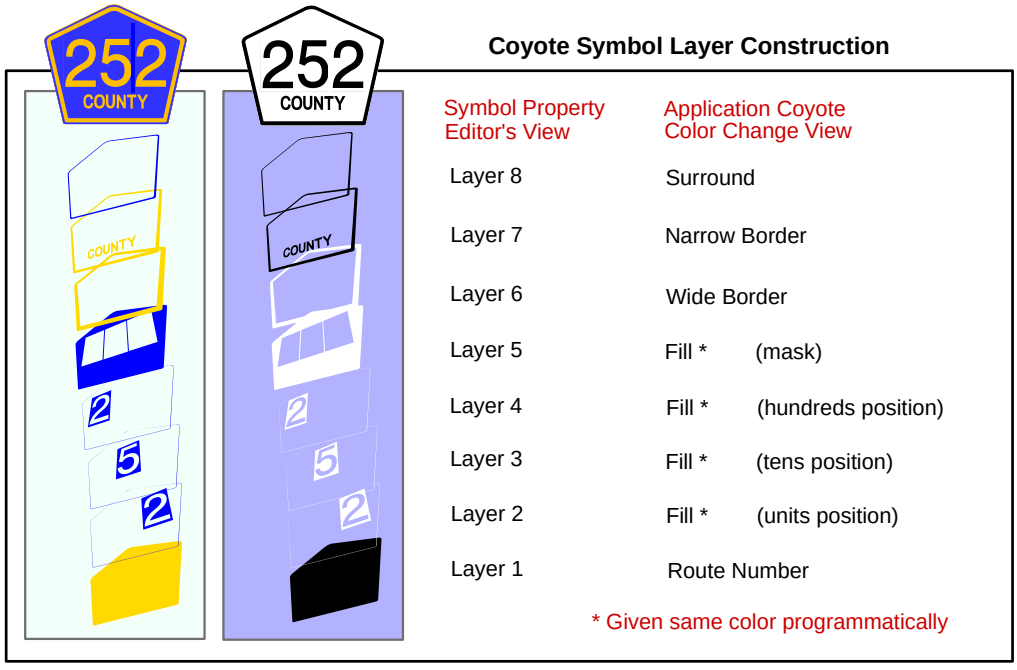
Picker with Define Custom Colors Activated



4.2.3 Symbol Layer Constructs

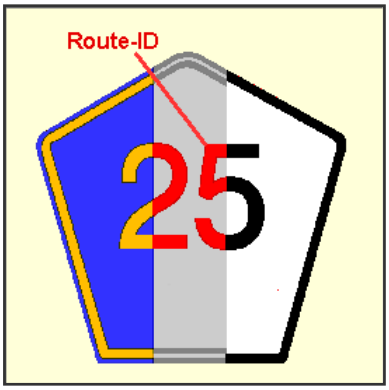
There is a difference between the symbol layers as represented in the various Coyotes and as they will appear in ArcMap's Symbol Property Editor (which shows the actual layers of the symbol). Because of the symbol design solution chosen, several layers need to have the same color applied to them. Coyote programmatically assigns the proper default/master color to the necessary layers. This means that fewer color choices have to be made in Coyote than when using the Symbol Property Editor.

Coyote Symbol Layer Construction

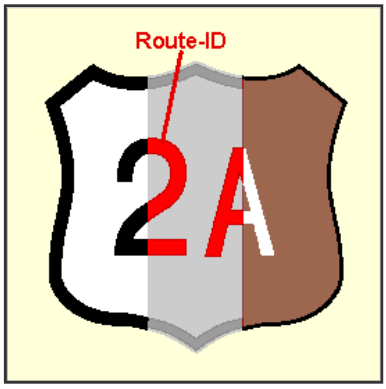


In the Wizard interface (later described), the user is stepped through color changes for each layer using color “maps” or guides, as is shown for the Route-ID layer in the examples below. One possible color scheme is shown on the left and another on the right. The middle (gray) sections highlight the portions of the symbol affected by a color change to that layer.

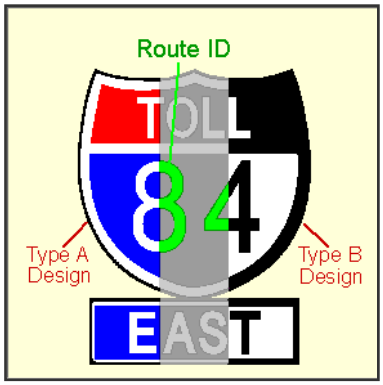
County Color Guide



US-Route Color Guide



Interstate Color Guide



4.2.4 Logic Control Switchover

In the first few Coyotes, processing of the Build Symbol module was controlled by a route ID If-Else evaluation tree which flowed sequentially by route ID (e.g. US-1, US-1A, US-1B, etc.) through all possible routes. The Master Table was in the same sequential order and, as the program proceeded down through each possible symbol, the Master was read to see if a symbol should be created. This was relatively easy to write and check out.

It was known that in many Coyote versions route IDs with alpha characters (US-1A, US-1B, etc.) would be used infrequently, if at all. As the suspected impact of the size of the Master Table became fully known, it was decided to switch processing control to the Master Table. The revised program’s main loop now became a new read DO loop, fields were added to the Master Table, and the Master Create module was revised to populate the new fields with values for each route ID character position. The route ID If-Else loop was revised to accept these values as parameters.

While this made for more complicated programming and testing, it allows the use of Master Tables with differing selections of route IDs. E.g.; For the US-Routes Coyote there is a numeric-only Master and a full Master. The numeric-only Master takes 3 seconds to open in a ListView. The full Master takes 20 seconds. The improved response that most users would receive was felt to be well worth the extra development and testing effort.

4.2.5 Headed Symbols

Marker symbols for routes such as US-20 ALT, US-50 BUS, etc. are referred to herein as headed routes, as the ALT, etc. are usually placed above the route numbers in DDV symbols. Headed symbol versions were intended for inclusion in appropriate Coyote versions from the beginning. Because of Master Table size concerns, it was decided to implement headed symbols not with separate records for each, but by adding Create “Yes”/”No” fields for each possible heading within the same record as the plain routes. To have used separate records would have increased Master size by a factor of twelve or more

Headed Route Implementation Sample

DDV's Application Coyote

Edit

Coyote Master Table Maintenance Form

Rec #	Num 1st	Route	US	Alt	Bus	Byp	Conn	Det	Hist	Loop	Old	Scen	Spur	Trk	R
000001	000001	US-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0
000002	000002	US-2	Yes	No	No	No	No	No	No	No	No	No	No	No	0
000003	000003	US-3	Yes	No	No	No	No	No	No	No	No	No	No	No	0
000004	000004	US-4	Yes	No	No	No	No	No	No	No	No	No	No	No	0

There is a tradeoff involved. Absent additional changes, both plain and headed symbols would have to use the same default or user defined symbol layer color schemes (see 4.2.8 Programmed Layer Color Control below). Subsequent testing showed that avoiding the additional records was the proper choice.

Headings to be included were initially chosen on the basis of those already used in DDV symbols. As the project progressed, it was realized that there were additional headings that could be useful and they were included. For consistent programming a common set of headings was employed with all Coyotes requiring them, even though this meant that some headings might not be used in a particular version. In one case it was necessary to revise an existing Coyote. This was accomplished with only a small additional effort. In another case a special use heading was accommodated by substitution for another that was not useful in that Coyote version. It should be noted that in the generic State Route set currently under development, many additional headings are being included in that Coyote version. This is being done in order to meet the unique requirements of several state route signing conventions.

DDV resisted any temptation to provide detour headed versions of other headed symbols. It was felt that the use of detour-related colors (orange and black) with standard headed versions and a corresponding map legend entry would be an acceptable alternative.

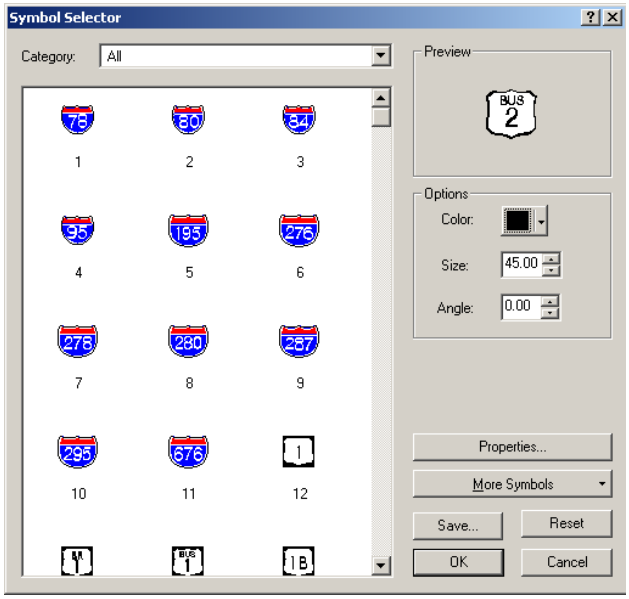
4.2.6 Symbol Name Prefix/Suffix

Pre-Coyote DDV highway symbols for the most part just used the sequential order in the symbol set as the symbol name in a Style, as in the example below-left. Because in Coyote the program could identify which symbol it was creating, it was feasible to include meaningful default symbol names as in below-right.

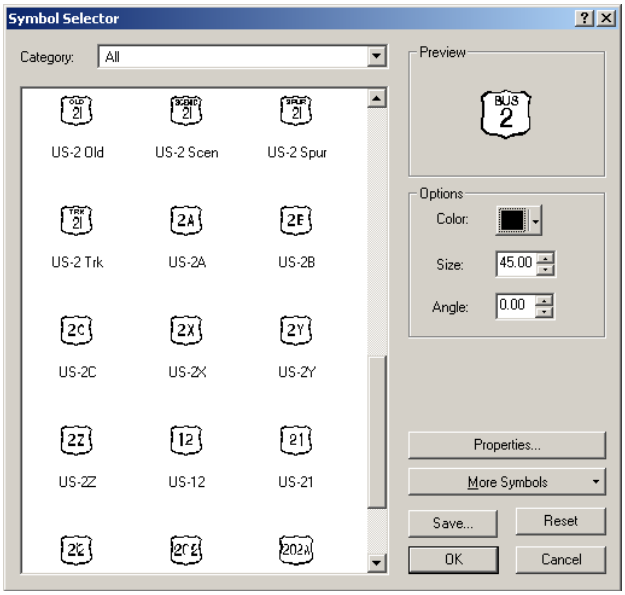
While this was useful visually in the Symbol Selector, it was not very useful for the purposes of using ArcMap's Match Symbols to a Style capability. Highway route name data file formats vary widely from jurisdiction to jurisdiction and it would be unlikely that any chosen naming convention would meet even a very small percentage of the user community needs. This is why the naming issue was never pursued in the original DDV symbols.

While programming the prefix and suffix values to append to the route number for the default symbol name, it was realized that if a user interface were provided, optional user input for the prefix and suffix could be implemented. The coding to accomplish this would not be difficult; the major development effort would be the necessary form. Since the ability to use Match Symbols to a Style could potentially save a very great deal of user effort, this enhancement was included. The user input is directly to the Build symbol module, it is not stored in the Master.

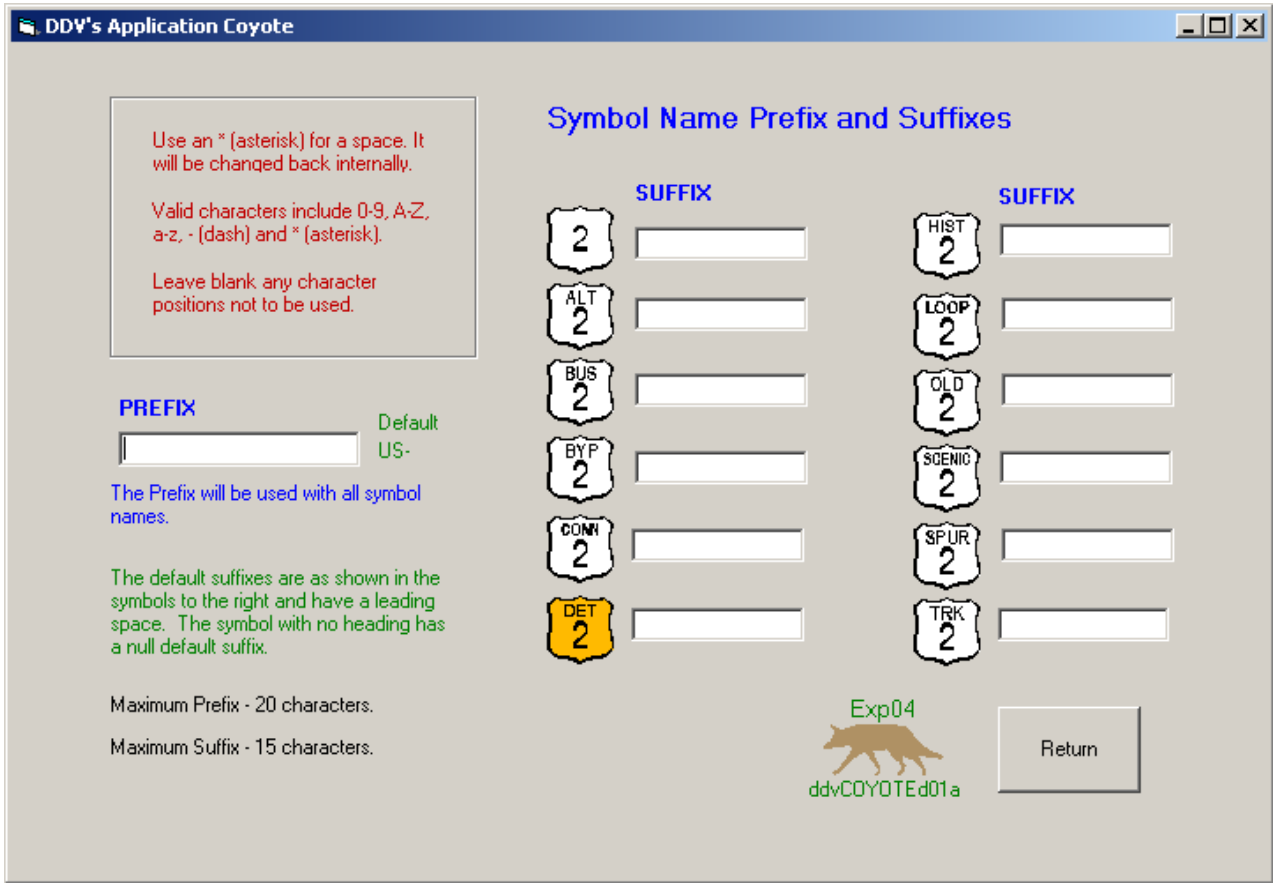
DDV Pre-Coyote Symbol Names



DDV Coyote Symbol Names



US Routes Prefix/Suffix Input Form


DDV's Application Coyote
Use an * (asterisk) for a space. It will be changed back internally.
Valid characters include 0-9, A-Z, a-z, - (dash) and * (asterisk).
Leave blank any character positions not to be used.
PREFIX
Default US-
The Prefix will be used with all symbol names.
The default suffixes are as shown in the symbols to the right and have a leading space. The symbol with no heading has a null default suffix.
Maximum Prefix - 20 characters.
Maximum Suffix - 15 characters.
Symbol Name Prefix and Suffixes
SUFFIX
SUFFIX
2
ALT 2
BUS 2
BYP 2
CONN 2
DET 2
HIST 2
LOOP 2
OLD 2
SCENIC 2
SPUR 2
TRK 2
Exp04
ddvCOYOTEd01a
Return

4.2.7 Directional Shields

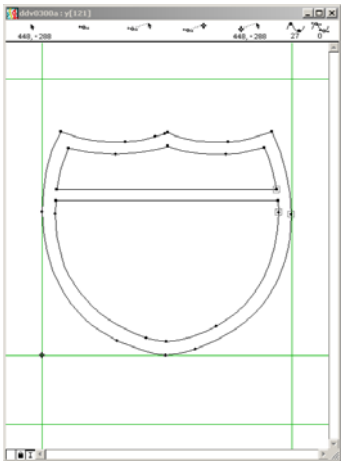
It was fairly important to DDV that similar size route numbers be maintained within different symbol designs. The route numbers on all symbols created in ArcMap with the same size property should have similar degrees of readability. Initial experiments with adding sign parts within the traditional font area used for creating glyphs (graphics) for marker symbols were not satisfactory to DDV and were only put into limited production. Considerable resizing work was required to produce them in this manner and working with smaller sized elements was more difficult.

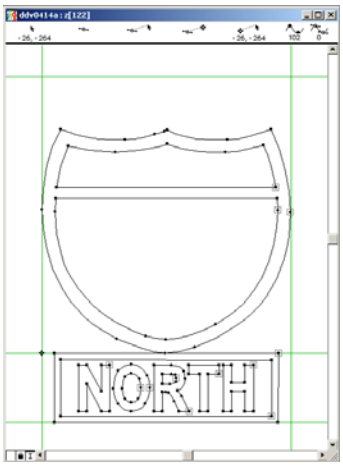
Size 50 Pre-Coyote Markers

Further experimentation with font creation software determined that it was feasible font-wise to add elements to already created normal-sized symbols without having to resize or otherwise rework the existing layers. This was accomplished by using the area in the font creation software's character window below the baseline down to the descent line (see illustrations below). The area below the baseline is not normally used when making font layer glyphs. Trial results looked good, but it was necessary to confirm with ESRI that using this area did not violate any ArcGIS restrictions on font use for marker symbols (thanks to ESRI's Jaynya Richards).

Font Creation Software Windows (Fontographer)

Baseline

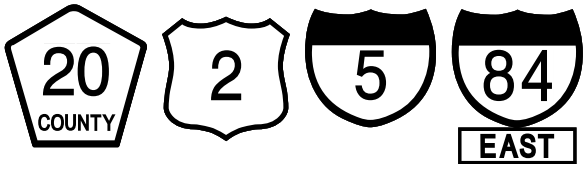




Descent Line

Not having to resize made it feasible to add directioned versions for Interstate routes. The user has a choice of standard and/or either North-South or East-West directioned symbols. Again for Master file size concerns, directioning was implemented by adding create "Yes"/"No" fields to existing records, rather than having separate records for each possibility. The Interstate Prefix/Suffix forms were constructed to include user input for directions as part of the symbol name.

Size 50 Coyote Markers



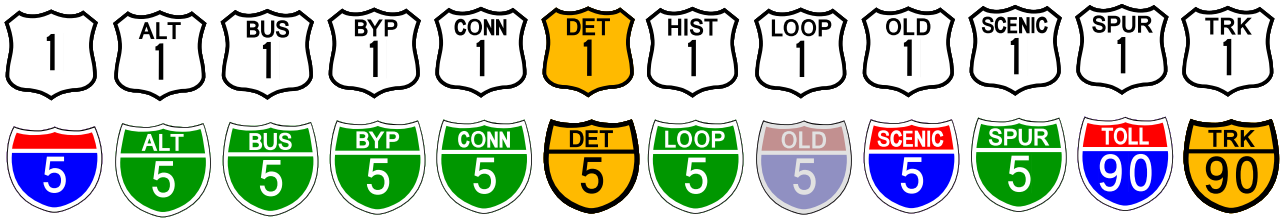
As a result of including both heading-create and direction-create choices in the same record, if directioned symbols are chosen, directioned versions of any selected heading choices will also be created. It was felt that this was an acceptable tradeoff for being able to keep a smaller size Master. (Having separate direction fields for each heading would have required too much effort from both the development and user-input aspects.)

4.2.8 Programmed Layer Color Control

For Interstate highway shields, headed versions (BUS, LOOP, etc.) typically are colored green and white as opposed to the plain Interstate's blue, red and white. This color distinction usually does not occur with US and state routes. To accommodate this, two sets of user-defined color fields are provided for the Interstate Coyote version.

There are several exceptions to the standard coloring mentioned above. To accommodate them, the Build Symbol module includes code to use alternate color schemes for some headings. For a default color source choice, the color results are illustrated below.

Default Color Scheme Programmed Colors



For user-defined color choices with US Routes the user-defined scheme is used for plain and all headed symbols. With the Interstate, the plain user-defined scheme is used for: plain, scenic and toll. The headed user-defined scheme is used for all others.

There are some cases where this approach may not give the desired results. Where it is necessary, the user can always change layer colors for symbols one-by-one using ArcMap's capabilities.

4.3 Coyote Feature Comparisons

The tables below reflect statuses as of late May 2005. Please check ArcScripts for the latest Application Coyotes available for download. This DDV Guide is unlikely to be updated unless significant feature additions and/or changes occur in future application versions.

Application Coyote Version	Unique Coyote ID	# of Masters	Master Route Range(s)	Status
European E-Routes	DdvCOYOTEa01a	1	1-9999	Done - held for retrofit
European A-Routes	DdvCOYOTEa02a	1	1-9999	Done - held for retrofit
European M-Routes	DdvCOYOTEa03a	1	1-9999	Done - held for retrofit
County Roads	DdvCOYOTEc01a	1	1-9999	In Production
US-Routes	DdvCOYOTEd01a	2	1-999 & 1-999Z	In Production
Interstate Routes	DdvCOYOTEe01b	2	1-999 & 1-99Z & H1-H9	In Production
State Routes (Generic)	ddvCOYOTEf01a	2	1-9999 & 1-999Z	Under Development

Application Coyote Version	Intro Forms	Wizard Interface	Exper'nced Interface	Layer Color Change	Headed Symbols	Prefix/ Suffix	Directioned Shields
European E-Routes	No	No	Yes	Yes	No	No	No
European A-Routes	No	No	Yes	Yes	No	No	No
European M-Routes	No	No	Yes	Yes	No	No	No
County Roads	Yes	Yes	Yes	Yes	No	No	No
US-Routes	Yes	Yes	Yes	Yes	Yes	Yes	No
Interstate Routes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Routes (Generic)	Yes	Yes	Yes	Yes	Yes	Yes	No

4.4 Application Workflow

The simplified workflow decision tree diagram on the next page outlines the major user decisions/choices made in the Coyote process. Progression from one form to another (with Back, Next and Return buttons) is omitted. Also omitted are the individual steps for selecting Master records, inputting prefix and suffix data, etc. Some user choices require action for one choice option, but not the other (E.g., push a button to copy the Master, otherwise ignore the button).

4.5 Future Application Directions

The currency caveat of the above topic also applies to this discussion. Priorities remain as established within the Project Plan. Timetables have not yet been set.

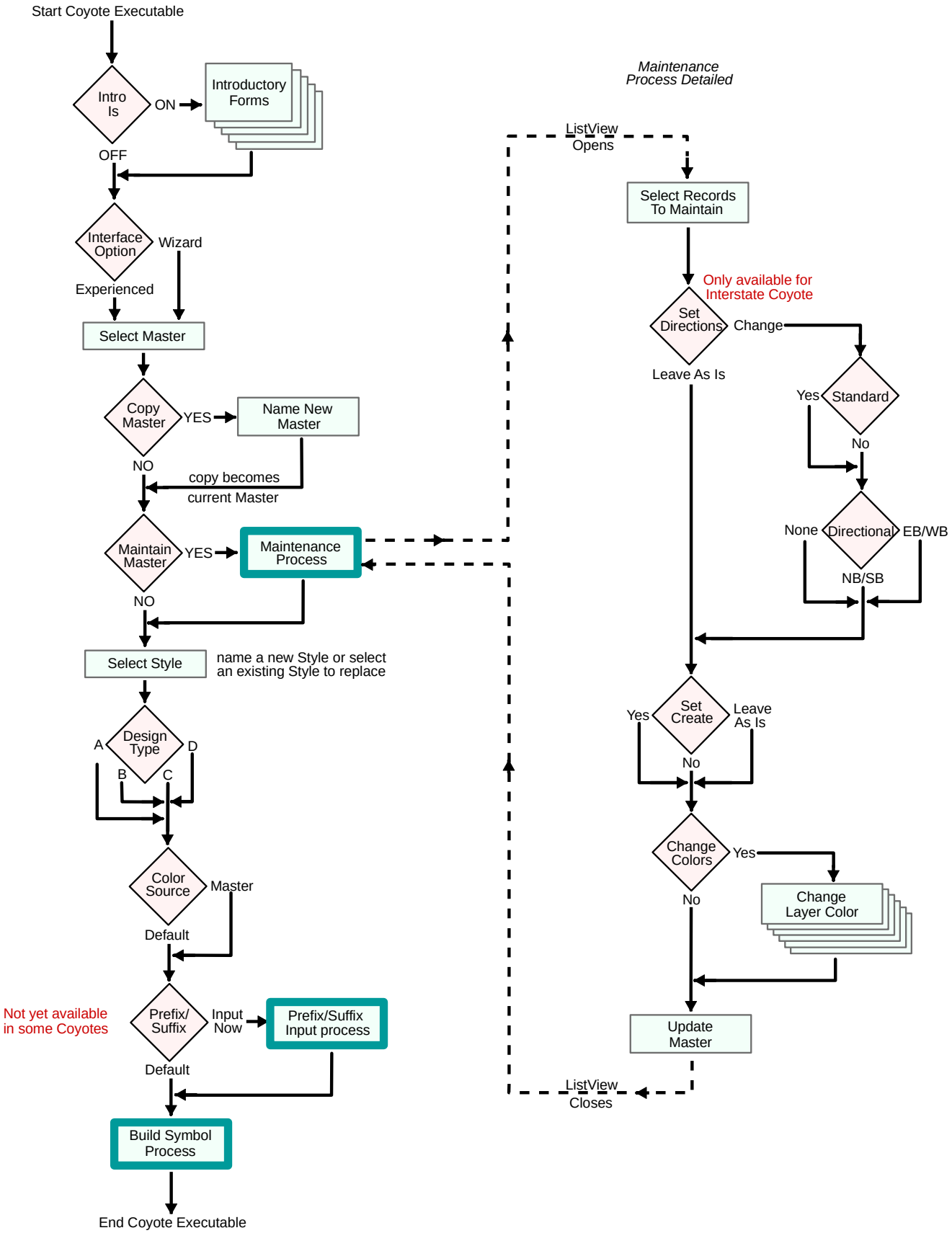
County Routes – This will be revised to include the symbol name Prefix/Suffix feature and alphabetic routes will be added. Other county route formats known to be in use include: AN, ANN, AAA, NNA, NAA, NAAA and possibly NNNA. It is believed that the resulting table size for some of these will severely impact Access response time. To help, several different master tables will be provided for these formats, but it remains to be seen if all can be accommodated as a practical matter.

European Routes – These were created first because they were easier to develop than other symbol sets. They were intended to "test the waters" for user acceptance with the European mapping community. As and if time allows (and especially if there is user demand), these will be retrofitted with introductory forms, wizards and the Symbol Name Prefix/Suffix feature. Until then, they will not be issued, as these features are deemed to be very important to successful use.

Existing Non-Coyote Sets – The following marker symbol sets have been in production for some time and consist of 999 or more symbols of which most users need only a limited selection. A number of these involve symbols other than those for highway routes. All are potential candidates to be "Coyoted" (which in a few cases may involve including a wider range of identifiers/numbers).

DDV's Highway Exit Number Alphanumeric Marker Stylesets
DDV's Highway Exit Number Marker Stylesets
DDV's Mile and Kilometer Marker Stylesets
DDV's Nat'l Fire Protection Assoc. Symbol Styleset

Simplified Workflow Decision Tree



SECTION 5 - LEARNING AND USING THE APPLICATION

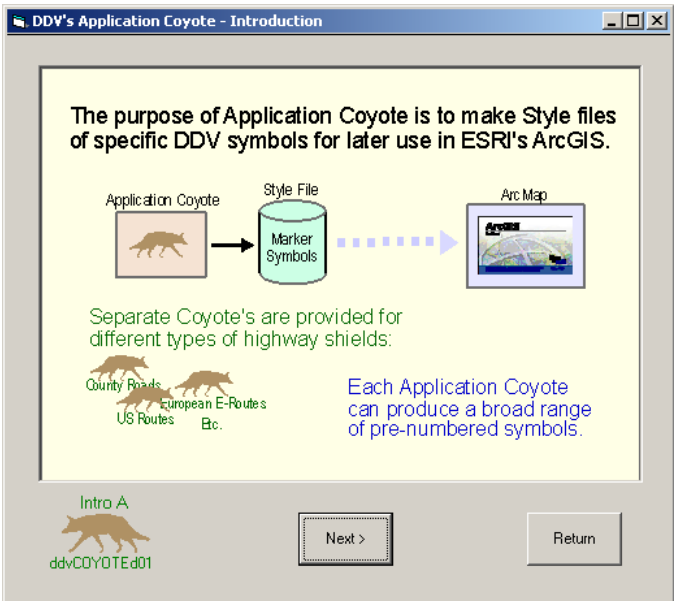
Introductory Forms and a Wizard-based user interface are the primary tools for learning to use this application. Message box error and warning messages also assist the user and there is a limited Help file.

5.1 Introductory Forms

While with Wizard guidance results could be produced even without understanding the concepts behind Coyote, DDV felt that people would be more likely to use Coyote and get more out of it if there was a user-friendly method of getting across the basics behind it. The idea of a separate user manual, even a very small one, was rejected. It is DDV's experience that these are often given only the most cursory glance, even ones as small as the typical PDF-based manuals distributed by DDV with pre-Coyote symbol sets.

Individual forms-based introductions were created for each different Coyote version. These use a lot of graphics. They outline both the basic concepts behind Coyote generally and point out a version's special features.

Introduction's Opening Form


DDV's Application Coyote - Introduction
The purpose of Application Coyote is to make Style files of specific DDV symbols for later use in ESRI's ArcGIS.
Application Coyote
Style File
Marker Symbols
Arc Map
Separate Coyote's are provided for different types of highway shields:
County Roads
US Routes
European E-Routes
Etc.
Each Application Coyote can produce a broad range of pre-numbered symbols.
Intro A
ddvCOYOTEd01
Next >
Return

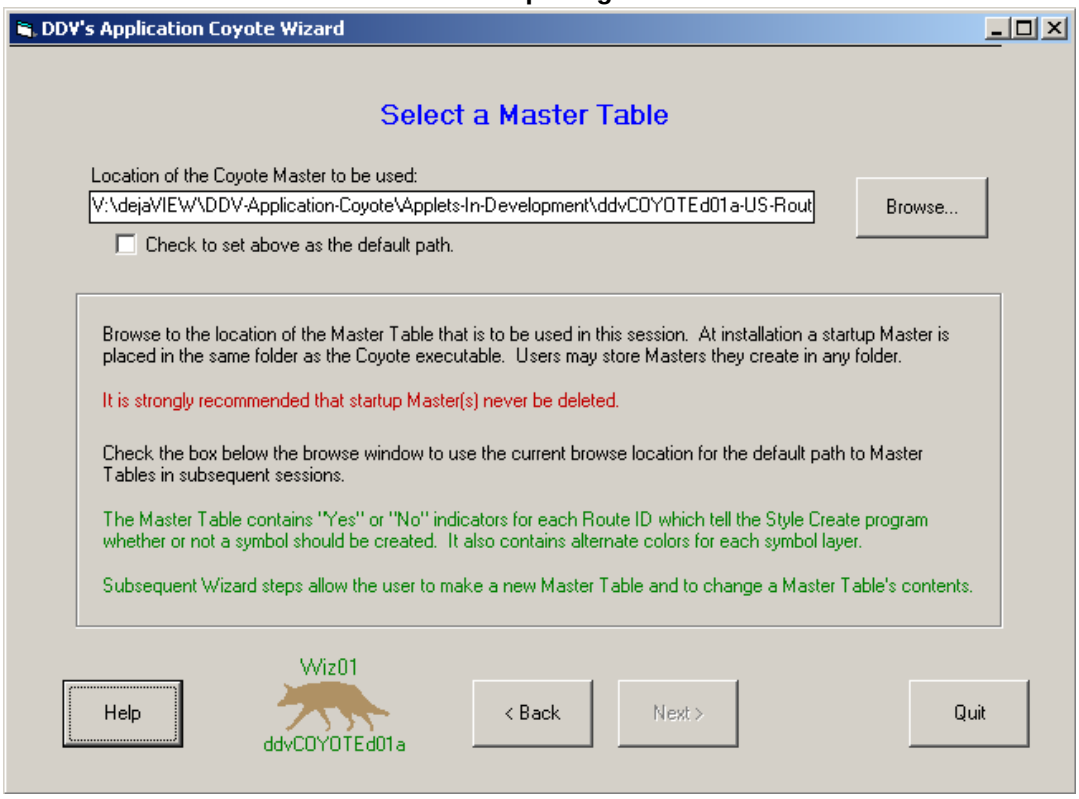
The Introduction is hard to ignore, as it automatically turns on whenever Coyote is run. The user can escape it at any time with Return and can also turn it off (or back on) so the next time the application is run it won't (or will) show. A Return from the Introduction takes the user to an opening form, where a choice of user interfaces is made (and where the automatic introduction can be turned on or off).

5.2 Wizard User Option

The first Application Coyote (European E-Routes) had minimal features and was developed only in what is now termed the Experienced user interface option. It underwent beta testing while further development was underway. The beta feedback, limited as it was, also was invaluable. For first-time users, the Coyote concept was not immediately obvious and the Experienced user forms were a bit overwhelming. Early on DDV had been considering a Wizard-based user interface, but as this would require much more development effort, hoped it would not be necessary. As a result of the beta feedback, the Wizard interface was developed and included.

Wizard forms are usually limited to one or two closely related tasks. They may include some information about the task, tips for carrying out the task and/or recommendations relative to it. Wizards step the user through the symbol creation process in the order that tasks should be carried out.

A Wizard's Opening Form

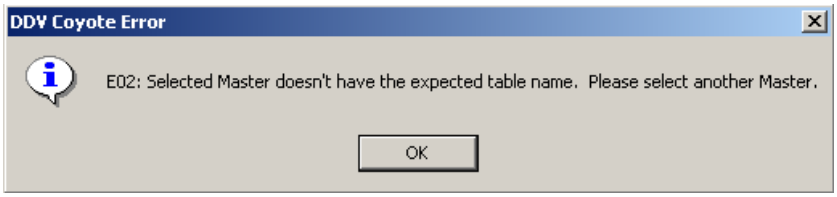

DDV's Application Coyote Wizard
Select a Master Table
Location of the Coyote Master to be used:
V:\dejaVIEW\DDV-Application-Coyote\Applets-In-Development\ddvCOYOTEd01a-US-Rout
Browse...
Check to set above as the default path.
Browse to the location of the Master Table that is to be used in this session. At installation a startup Master is placed in the same folder as the Coyote executable. Users may store Masters they create in any folder.
It is strongly recommended that startup Master(s) never be deleted.
Check the box below the browse window to use the current browse location for the default path to Master Tables in subsequent sessions.
The Master Table contains "Yes" or "No" indicators for each Route ID which tell the Style Create program whether or not a symbol should be created. It also contains alternate colors for each symbol layer.
Subsequent Wizard steps allow the user to make a new Master Table and to change a Master Table's contents.
Wiz01
ddvCOYOTEd01a
Help
< Back
Next >
Quit

5.3 Experienced User Option

Having significant experience using Coyotes, DDV felt the first-tried, quicker-to-use Experienced option should also remain. When developing new Coyotes versions, this quicker-to-develop option is implemented and tested before developing the Wizard option.

5.4 Error and Warning Messages

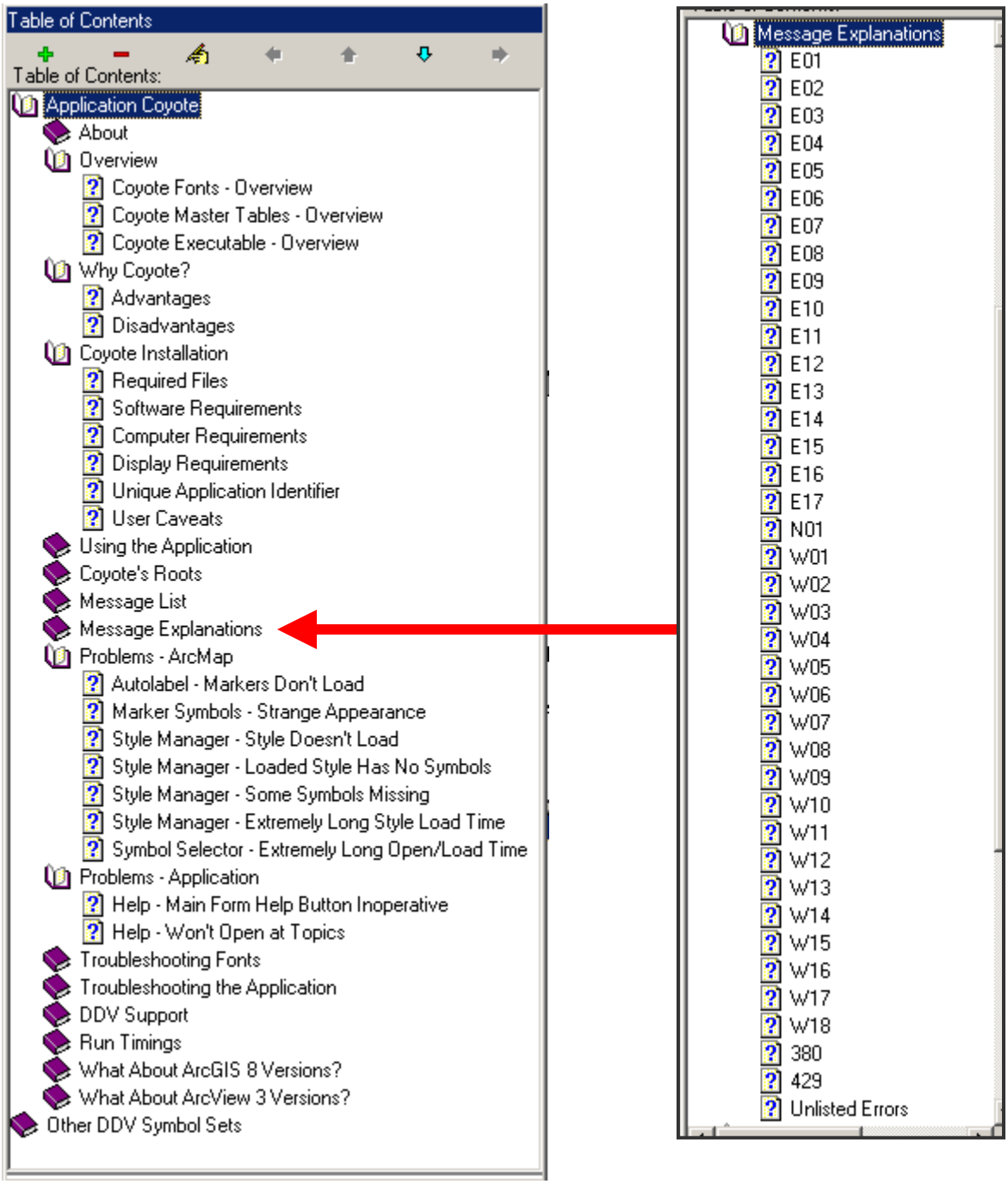
Message boxes are used to communicate error conditions and warnings to the user. The error messages are especially useful in the Experienced option if users inadvertently skip steps. In the Wizard option some command buttons are not enabled until the prerequisite step has been completed, avoiding the need for some error messages. However warning messages are used extensively in both. These call attention to unusual (but not necessarily erroneous) choices, ensure the user really wants to quit before a process is finished, etc. The Help file contains a complete list of error messages (ordered by message ID; e.g., "E02") with jumps to explanations should the user need guidance beyond the message's content.



5.5 Help File

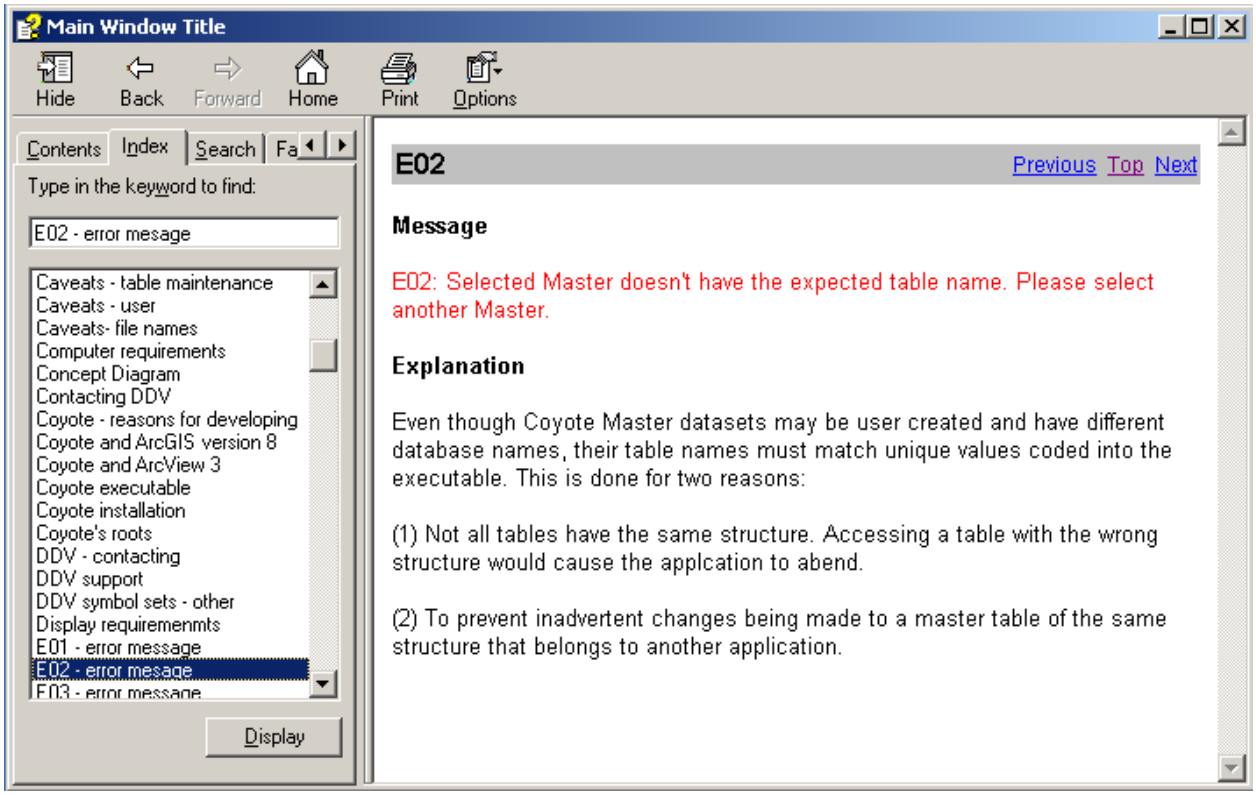
The application's Help file was created as an HTML Help rather than the classic Windows Help. This may not have been the best choice. To this point DDV has been unable to implement jumps from within the application to specific Help topics. It is understood that this is a known difficulty with HTML Help. In DDV's view this is only a minor hindrance and, given the DDV workload, is not being pursued at this time.

Coyote Help (All Topics Expanded)



As can be seen from the topic list, Help concentrates on application messages, user problems and troubleshooting. When it was decided to implement the wizard interface and introductory forms, most material on learning and using Coyote that was originally in the Help file was removed, as it could be more easily covered and was more readily accessible from these new components. Not having the material covered in multiple components was a DDV maintenance workload issue.

Coyote Help Index


Main Window Title
Hide
Back
Forward
Home
Print
Options
Contents
Index
Search
Type in the keyword to find:
E02 - error mesage
Caveats - table maintenance
Caveats - user
Caveats- file names
Computer requirements
Concept Diagram
Contacting DDV
Coyote - reasons for developing
Coyote and ArcGIS version 8
Coyote and ArcView 3
Coyote executable
Coyote installation
Coyote's roots
DDV - contacting
DDV support
DDV symbol sets - other
Display requiremenmts
E01 - error message
E02 - error mesage
Display
E02
Previous Top Next
Message
E02: Selected Master doesn't have the expected table name. Please select another Master.
Explanation
Even though Coyote Master datasets may be user created and have different database names, their table names must match unique values coded into the executable. This is done for two reasons:
(1) Not all tables have the same structure. Accessing a table with the wrong structure would cause the applcation to abend.
(2) To prevent inadvertent changes being made to a master table of the same structure that belongs to another application.

Most of the Help file content is not changed from one version of Coyote to another. Exceptions are version identification and required files information, which are specific to each Coyote. The issue of new Coyote-generated messages is handled by adding them to the Help issued with the Coyote where they were created (and all subsequent Coyotes). Help for already in production Coyotes is not updated, as the messages are not relevant there. Again, this is a DDV maintenance workload issue.